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COMMISSION

GOVERNMENT USE OF THE CALIFORNIA GASOLINE FORWARD MARKET

DRAFT CONSULTANT REPORT

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Executive Summary

The purpose of this project was to investigate the forward market within California for gasoline and the feasibility of state agencies buying bulk gasoline in that forward market.

Efficient and liquid forward markets provide an important relief mechanism during occasional periods of price volatility, which are typically due to refinery disruptions. Importers use forward markets to hedge the price risk associated with importing petroleum products over long distances, or more straightforwardly, to arbitrage across space and time. If California's forward markets do not provide a sufficient level of liquidity – itself the key question of this project – the ability of forward markets to provide a hedging and arbitrage mechanism to importers is impaired. If shipments would not be made, the result would be higher and longer lasting gasoline price spikes during refinery outages than would otherwise have been the case.

Previously, staff identified a likely contributing factor to California's relatively illiquid forward market is a lack of buyers relative to the number of possible sellers of forward contracts.[1] Staff has also identified that a variety of state agencies purchase gasoline in bulk, through procurement contracts with distributors tied to prices reported in wholesale markets. If these agencies were to purchase their fuel in the forward market as opposed to the spot market, the state would enhance the volume of buying in the forward market. If the forward market were lacking liquidity, the additional volume for the state might be sufficient to provide the critical level of liquidity required to facilitate forward sales by gasoline importers.

Summary of Findings

To learn about the forward market for gasoline, and to investigate the feasibility of government agencies executing their purchases in the forward market, the research team conducted a series of some twenty-stakeholder meetings with a cross section of California's petroleum industry. The following are the most significant findings:

- The forward market, which involves the two main pipeline routes, appears to be more active in southern than in northern California.

- The trading that occurs in California's forward market typically has a maturity of one month and occasionally two months. Given the logistics of California's petroleum industry, the lack of three-month or longer maturities is not surprising.

- Typical daily volume is in the range of three to five trades.

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[1] See the California Energy Commission report contract #300-96-014, *The Status of Paper Markets for Energy*, by Philip K. Verleger, September 25, 1997.

- There does not appear to be a systematic imbalance between the number of potential sellers and buyers, despite earlier impressions.

- Market participants have surprisingly diverse views on how liquid is the forward market in California, but no one says the prices are not plausible or that deals cannot be done.

- The one-month forward price is often substantially below the spot price, a price pattern known as backwardation. These backwardations often occur at the time of the so-called spikes in the spot price of gasoline, which is a correlation consistent with behavior in other commodity markets.

- Delivery terms, credit checks, pipeline congestion, and other details of the forward market are not themselves impeding trading.

- The standard quantity in these forward markets – 25,000 barrels – inhibits smaller traders, but this large quantity comes primarily from logistics.

- No other barriers to entry are apparent.

- Collectively, the state agencies purchase gasoline equivalent to one standard pipeline lot per week.

- State agencies, needing smaller quantities at many locations, would have no direct need for a standard pipeline lot; private distributors would necessarily be involved.

In conclusion, it is not at all obvious that illiquidity in the forward market impairs importers. If anything, there is sufficient liquidity for importers. In any case, it is not clear that the state's active participation would make much difference in the operation of the forward market. Whether state agencies would be advised for their own sakes to base procurement contracts on the forward market is yet another question.

I. Introduction

Compared to other areas of the United States (U.S.), California seems to have more variability in the spot price of gasoline even as it has a relatively inactive forward market for gasoline. It is natural to wonder whether a more active forward market would itself dampen variability in the spot price of gasoline. This study first of all aimed to learn about the existing forward market in California, as a step to recommending how it might be improved.[2]

Ideally, forward prices serve as the signal guiding the accumulation or release of inventories and as the signal attracting imports of gasoline, since imports take time to arrive and storage by its nature allows adjustment between current and future conditions. Forward prices can serve as signals for a particular firm even if it does not trade in the forward market, provided the trades of others are reported. For those who do trade, the forward market converts highly risky ventures, such as a cargo sent across the Pacific with the hope that the spot price in California will still be high when the tanker arrives, into nearly certain, arbitrage-like operations.

Despite their advantages, forward markets are delicate institutions, easily disrupted by disputes over the performance of contracts after months have passed and conditions have changed. For a prospective importer of gasoline, the difficulty of finding counterparties who reliably perform their side of contracts acts much like a transaction cost such as a brokerage fee. Similarly, for a prospective importer of gasoline, the need to discount price to place the large volume of a typical tanker acts much like a transaction fee. Such costs broadly categorized as illiquidity are comparable to a tariff applied to imports, perhaps a tariff sufficiently high to preclude those imports.

Or to put that impediment due to illiquidity more hopefully: Reform of some small aspect of a forward market, such as minor adjustments to the prevailing terms of delivery, the reduction of credit risk through “netting” of trades, or the more consistent use of the market by some subset of traders, can attract additional volume. That increase in volume can attract yet more trading, and so increase liquidity as to eliminate the “tariff” on imports, thereby inviting the imports that would reduce price spikes. Perhaps the State of California, by redirecting its agencies’ bulk purchases of gasoline to the forward market, could set in motion this virtuous cycle. This study also aimed to determine whether the State of California had sufficient volume and flexibility to make this approach the recommended means for improving the forward market.

This proposition – that the State of California, by redirecting public purchases of gasoline to the forward market, would make the forward market more liquid and that liquidity in turn would make possible private traders’ imports – presupposes that three conditions hold. It is advisable to make the logical sequence of these three conditions as clear as possible. Indeed, this report will be organized around the three conditions.

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[2] A glossary of the many terms related to forward markets and to gasoline follows the main text of this report.

The first required condition, which may be so obvious as to be invisible, is that California would likely import gasoline during local disruptions. If the time involved is too great compared to a refinery outage or the freight rate always too high, any "tariff from illiquidity" in the forward market would not matter, since the absence of imports cannot be further discouraged. Second, the existing forward market needs to be poor by objective measures, either in terms of its price signals or its liquidity. Should the "tariff from illiquidity," however large it is compared to the most active forward markets, not be very high relative to other influences on California gasoline, the existing forward market is unlikely to be a significant impediment to imports. Third, the state agencies need to purchase a sufficient quantity that its redirection to the forward market would matter to the normal volume in the forward market. In short, the issue of the state's bulk purchases in the forward market is important should those forward trades put importers over the cusp of sending gasoline to California.

It is also advisable to make clear that "forward market" encompasses many markets, just as the category "gasoline" encompasses many commodities. An active forward market, such as the Brent crude forward market, involves a number of months into the future, namely one-month-ahead, two-months-ahead, three-months-ahead, and so on. For that matter, the divisions could be finer than a month; sometimes first-half and second-half are traded separately. Among these possibilities, the six-month-ahead market might trade irregularly while the two-month-ahead market could be so active as to serve as a benchmark for other regional markets. From this perspective of a constellation of delivery dates, the "spot market" is simply one with a very short horizon, and not necessarily the most important in the set.

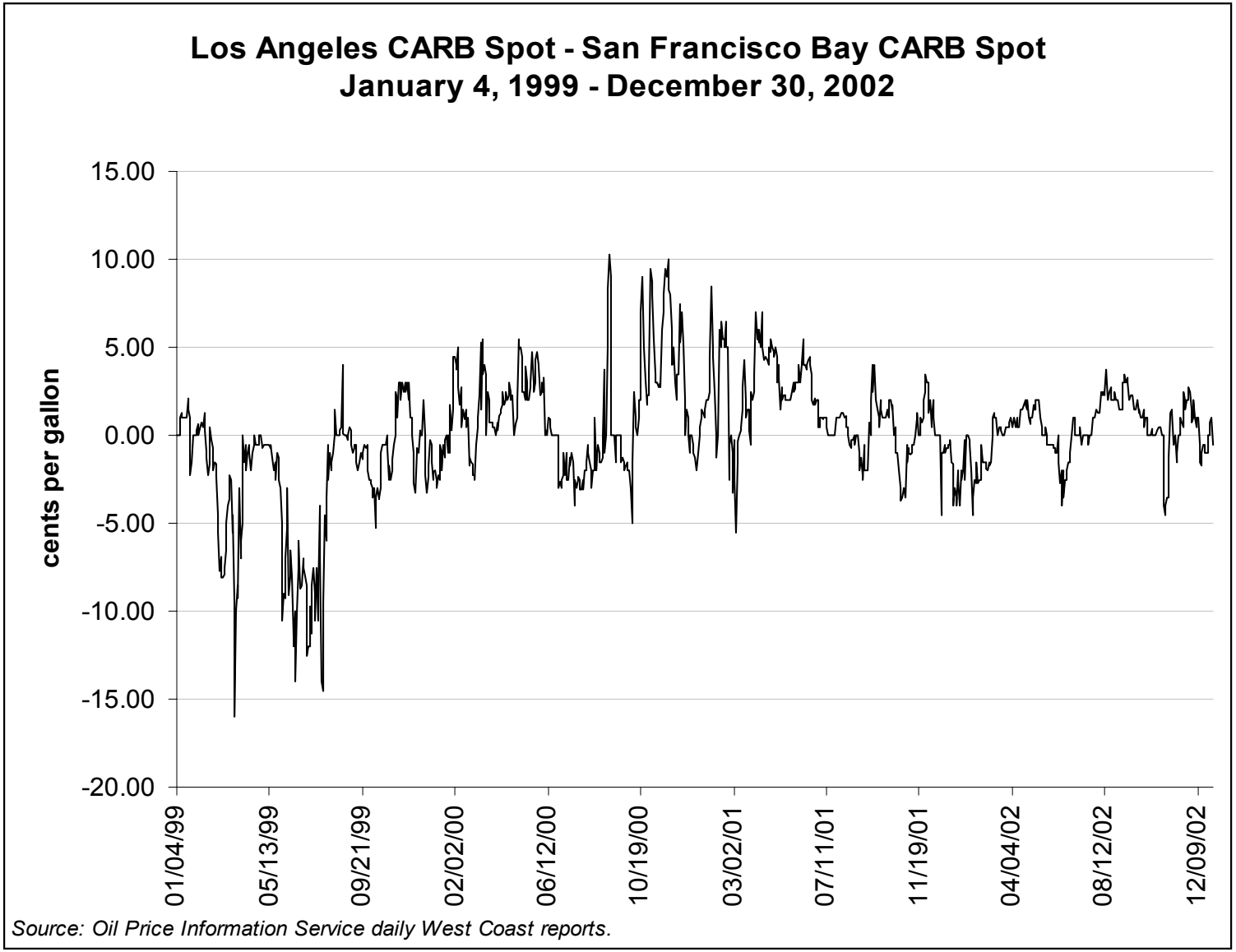
II. California As A Price Island In Gasoline

Increasingly popular is the metaphor of California as an island, where separated by distance and the specifications mandated by the California Air Resources Board (CARB), gasoline prices move somewhat independently of prices in other regions. Many of the stakeholders interviewed invoked the island metaphor at some point, especially regarding the effects of the California-specific specifications. This island metaphor is indeed useful for understanding the price effects of a local disruption. If gasoline were homogeneous everywhere and if all regions were interconnected (or equivalently, if transport costs and time were trivial), any local shock would be dissipated throughout the system. The metaphor of an island succinctly represents California's circumstances arising from the state's geographical separateness from refinery centers, especially those few now able to produce gasoline to California specifications.

The metaphor of California as a price island in gasoline needs some elaboration, nevertheless. First, because of the proliferation of boutique fuels across the U.S., California is no longer the only island market for gasoline in the country.[3] Each local environmental authority specifying a slightly different gasoline or slightly different rules for seasonal changes in specification adds to the U.S. Archipelago. Presumably, the local price spikes in other islands when they have local disruptions ripple through to California to some extent. No island is disconnected entirely, not least because crude itself can be redirected. Second, California is better thought of as two close islands, namely San Francisco Bay plus nearby and Los Angeles plus nearby. As Figure 1 shows, prices differ in the two locations within California, although not nearly as much as either California location sometimes differ from those elsewhere in the U.S. Third, the island metaphor includes the dimension of time as well as space. If specific specifications preclude that gasoline could come from Seattle but must come from farther away, perhaps as far away as Singapore, the increase in distance alone implies that California gasoline prices must rise more than previously to attract imports. But that increased distance also implies that California must rely on local production longer, since shipments from Singapore take longer to arrive than shipments from Seattle. Fourth, it matters to the metaphor that California the island is not routinely importing.

[3] See the EPA report, *Study of Unique Gasoline Fuel Blends ("Boutique Fuels") Effects on fuel Supply and distribution and Potential Improvements*, http://www.epa.gov/otaq/regs/fuels/p01004.PDF

Figure 1



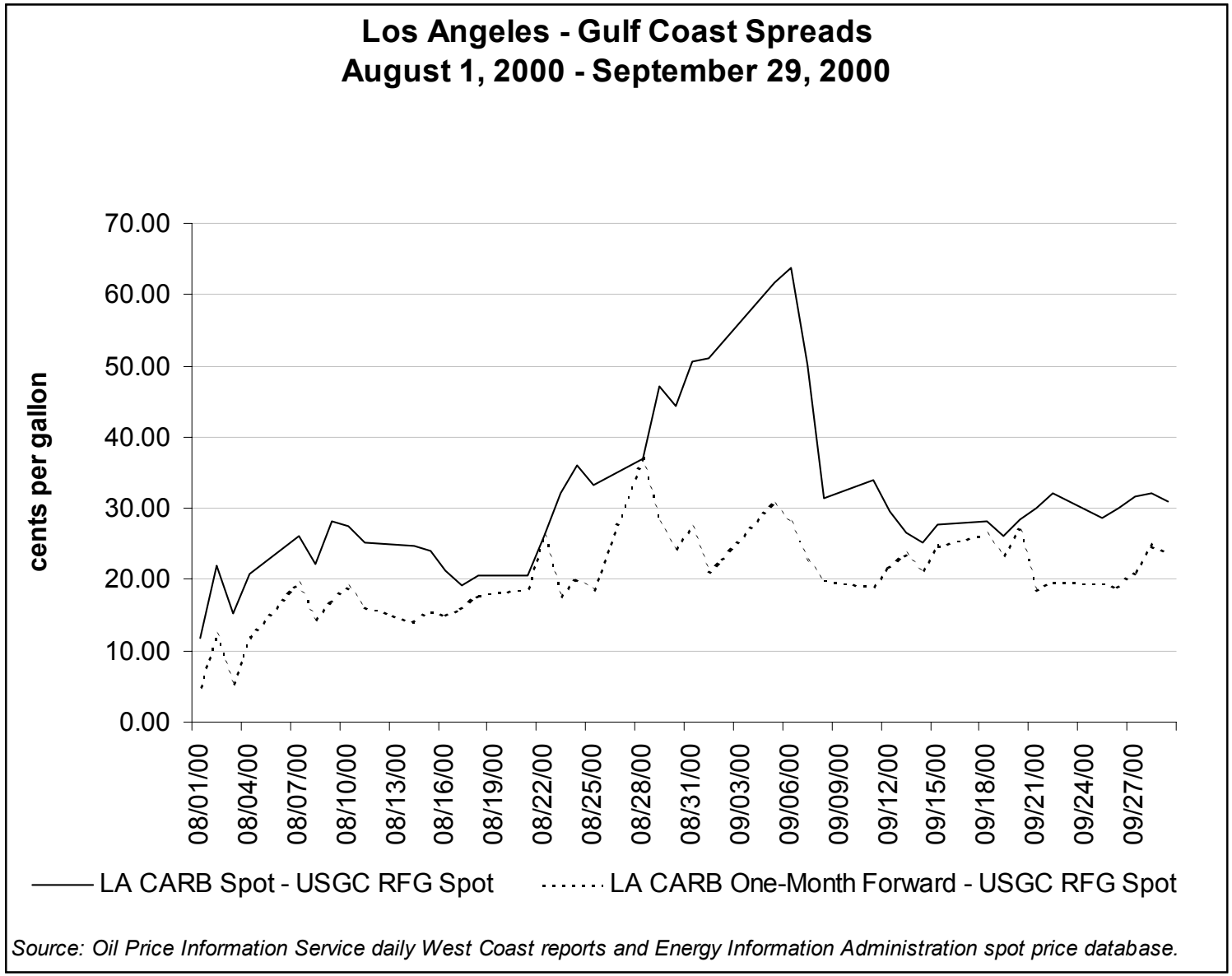
Source: Oil Price Information Service daily West Coast reports.

If the U.S. Gulf Coast, say, were always sending gasoline to California, at some fairly constant tanker rate, prices would move up and down nearly in parallel – the amount shipped, not regional price differentials, would be the mechanism absorbing the shocks within California.

Consider the sensible responses within an archipelago when one large island on the outer reaches has a major refinery outage. Although some islands are only one week away, those who could make the same specification are one month away. Only if the disruption on the large island were known to last more than one month would the rest of the archipelago be able to help the large island with the disruption. (One stakeholder made this very point about California.) Otherwise, decreased local consumption and whatever increased production is possible at other refineries on the large island must make up for the disruption. That is to say, the spot price and forward prices out to three weeks will spike considerably. If the disruption looks likely to last a month or more, the price for delivery in one month would rise, probably sufficiently to induce shipments from elsewhere in the archipelago. Only if the local response involves some tradeoff between the first month and the second month would the relief from imports have an effect on prices in the first month. (Such a connection between the two months could occur, say, through the pattern in the drawdown of inventories or through the delay of maintenance on refineries, which would allow increased production temporarily.) Because a shipment arriving in one month is sent immediately, the large island's disruption has an effect on the spot price of the exporting island, and perhaps on others who would otherwise routinely trade with that exporting island. In short, the pass through of shocks onto prices is quite complicated when both space and time are involved.

As regards California's price spikes, the relevant comparison of spatial prices should allow for the time required for the shipment. The comparison of spot prices in two locations, say California and the U.S. Gulf Coast as in Figure 2, are irrelevant for judging arbitrage possibilities, the existence of which would otherwise seem to be suggested by prices in California 60 cents higher than in the U.S. Gulf. During late August and early September of 2000, this spot spatial spread was sustained well over the estimated import parity, largely due to disruptions in California refining and to California pipeline shipments, those disruptions in turn due to local blackouts in electricity. An outside estimate of tanker costs and specification differences might be as much as 30 cents per gallon, much less than the 60 cent differential.

Figure 2



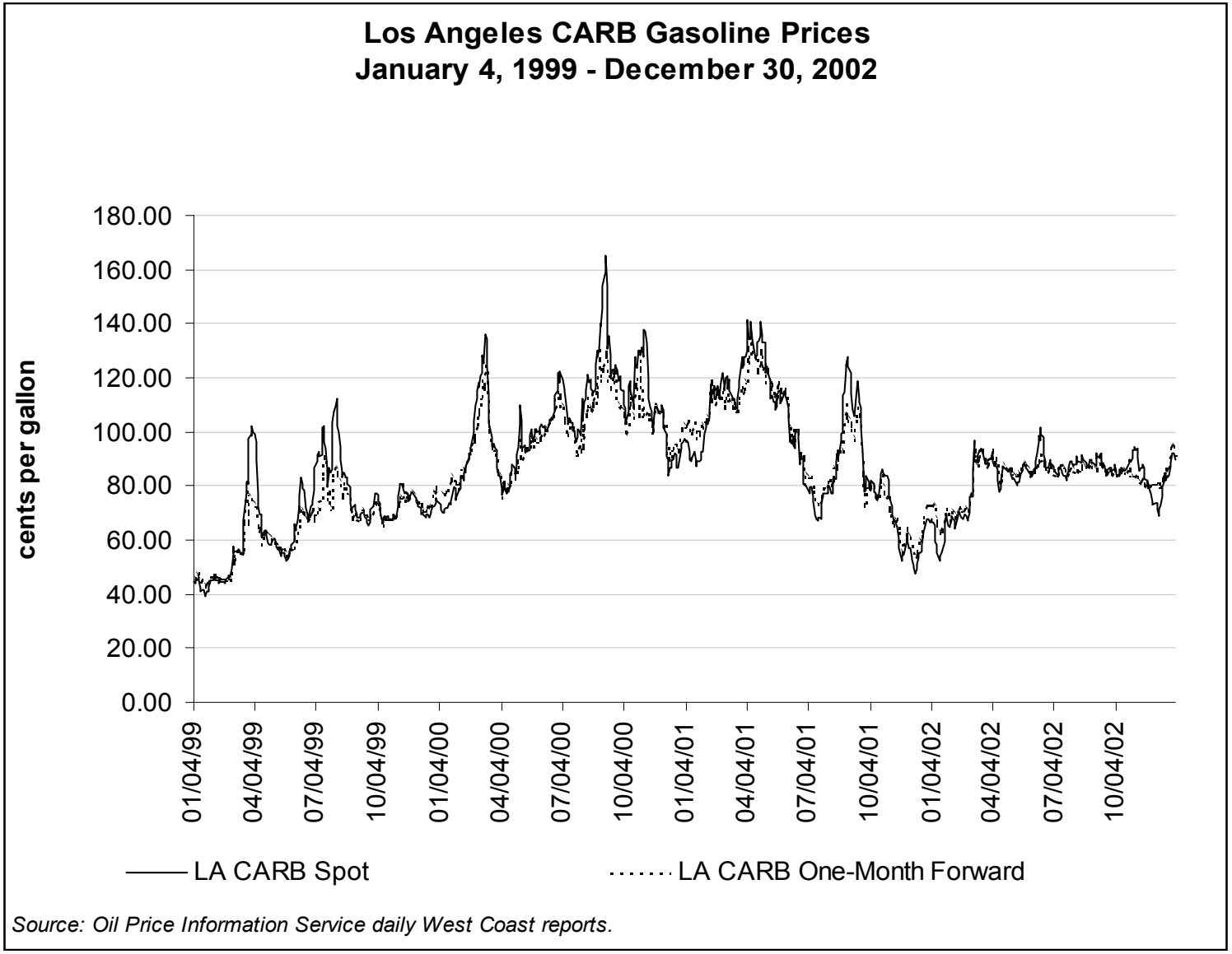
Source: Oil Price Information Service daily West Coast reports and Energy Information Administration spot price database.

For the spot spatial spread to reflect import incentives, however, gasoline must be transported from the U.S. Gulf Coast within one day. No one can move gasoline on that route within one day. It takes at least two or three weeks. The relevant comparison is thus between the spot price on the U.S. Gulf Coast (or better yet, a location where California specification gasoline is produced) and the price relevant for the time taken in transit, namely the one-month-forward price in Los Angeles. Over those days in August and September 2000 with a noticeable price spike, the Los Angeles forward price minus the U.S. Gulf Coast spot price was within the range of 30 cents (or less) on all but one day, and just barely over 30 cents on that one day. According to Figure 2, any arbitrage opportunities were fleeting and were acted upon, since the differential closely approximated shipping costs. Indeed, a number of cargoes were sent to California during that period. Similarly, during other price spikes, the one-month forward price is almost always within 30 cents of the U.S. Gulf Coast price, whatever the relationship between the two regions' spot prices. And during those periods, exports were sent on their way to California.

As Figures 3 and 4 illustrate, most often when a spike occurs in the spot price of gasoline, the one-month-ahead forward price (given for Los Angeles delivery in Figures 3 and 4) is substantially below the spot price. This discount, of ten, twenty, even thirty cents per gallon, does not measure the illiquidity in the forward market, namely the price a seller (or buyer) must offer to entice an offer. The discount reflects the pressure for immediate delivery of gasoline, which can be relieved in one month. This premium for immediate delivery – equivalently, a discount for later delivery – is known as a "backwardation" in the terminology of other commodity markets, where it is common even in the most active forward markets. (Indeed, the need to reflect backwardations as a price signal may be the major reason those markets are so active.) That is to say, the gasoline forward market as it does exist in California looks to display intertemporal price relationships much as do other forward markets, whether for gasoline or for other commodities.

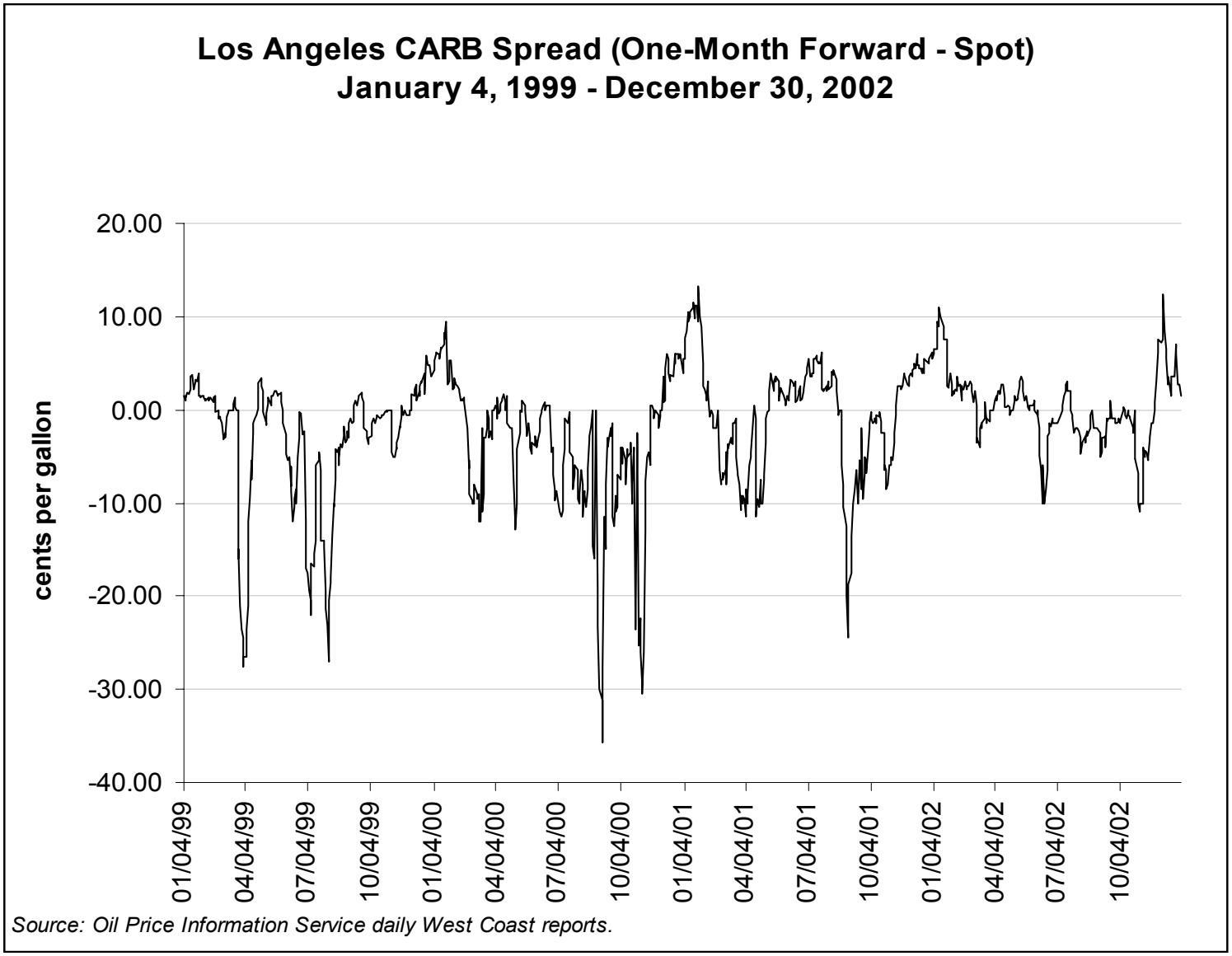
In sum, it appears that the first condition holds for California, namely that California is likely to import gasoline during local disruptions (and principally during those disruptions). Even so, that evidence is like a two-edged sword. Those imports appear to be a response to the relationship between the one-month-forward market in Los Angeles and spot exporting markets, which accords with the typical time of shipments. That fact itself suggests that the forward market in California is already performing its principal role as a signal for imports, quite apart from any additional liquidity provided by state agencies' trading.

Figure 3



Source: Oil Price Information Service daily West Coast reports.

Figure 4



Source: Oil Price Information Service daily West Coast reports.

III. Forward Gasoline Markets In California

With an ever-increasing gasoline demand of roughly one million barrels per day in California, one might expect comparable volume in a forward market. Northwest Europe, Singapore, New York Harbor (including NYMEX), the U.S. Gulf Coast, and Tokyo Harbor (including TOCOM) have developed forward markets with such volume. According to all stakeholders interviewed, the forward market for gasoline in California does not approach close to a volume of one million barrels per day. Many would estimate the volume to be on the order of 100,000 barrels per day, with the majority involving gasoline in Los Angeles.

The range around this mean estimate is surprisingly wide, and with it the perceived "depth" of the forward market. Some stakeholders thought it unlikely that they could sell as many as 100,000 barrels without a detrimental effect of the price while a few thoughts that the market could absorb 300,000 at prevailing prices. Most stakeholders agree that a transaction for twenty-five thousand barrels, or 2.5 percent of the daily California gasoline flow, can influence the price for unbranded gasoline, whether prompt or forward barrels. In that sense, the forward market is no more nor less liquid that the spot and prompt markets. Many stakeholders perceive that the liquidity of the forward market has been increasing in recent years. Perhaps the discrepancy in their estimates of the depth relates to the period they are remembering.

According to stakeholders, concerns about the creditworthiness of counterparties are not pronounced in the forward market. It is not that no credit risks exist. Rather they are so prevalent – even a tanker truck filling at a rack takes away gasoline worth some $10,000 – that the industry has put in place considerable checks and controls, which apply part and parcel to forward transactions. Stakeholders do remember one default and bankruptcy several years ago, but the memory does not impede trading today.[4] When asked about peculiar delivery rules, lot sizes no longer sensible, or trading customs giving too much advantage to one side of a bargain, stakeholders could think of no such problems discouraging forward trading. Nor did they mention a structural imbalance, such as too many offers to sell forward compared to offers to buy forward. Perhaps this balance has changed from six years ago.

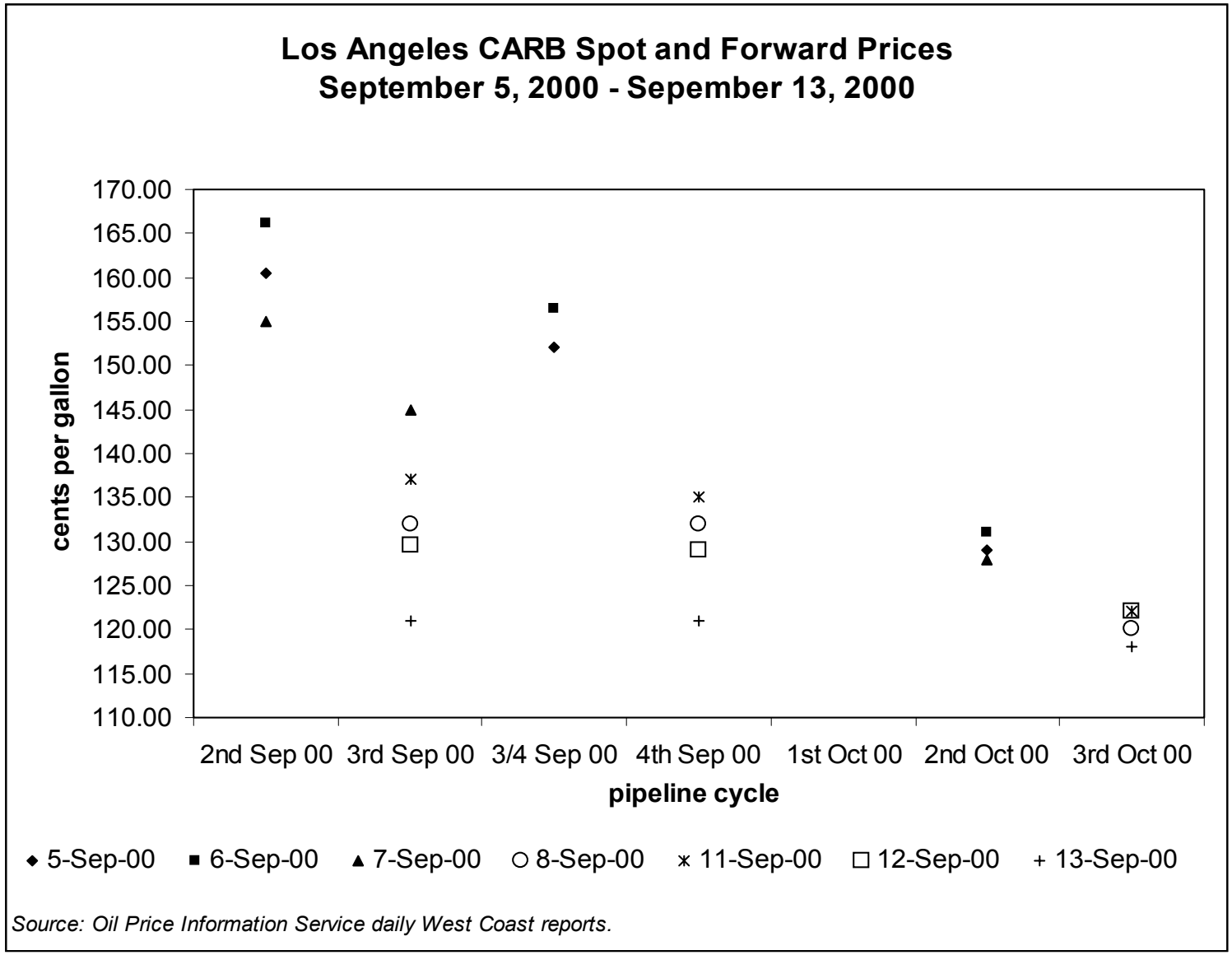
The forward trading that does occur in California extends one month ahead, sometimes two months ahead, and almost never any farther. Sometimes individual weeks are distinguished, as in the example in Figure 5, which demonstrates the each weekly cycle in September traded at a different price as of early September. The forward trading concerns the scheduled pipeline flows, principally in the major pipeline coming out of Los Angeles and to a lesser extent on the pipeline from San Francisco east towards Sacramento. Pipeline batches, usually in a "piece" of 25,000 barrels, are bought and sold between all market participants on a daily basis. Prices for "prompt" shipment during the next week-long cycle on the pipeline are what OPIS and Platts report as the

[4] The Oil Daily, "Trader's bankruptcy raises warning flags," March 18, 1998.

”spot market price” of the day; those for more distant cycles are the reported forward prices. The estimated daily volume in the forward market of 100,000 barrels thus corresponds to four trades per day.

The nature of the forward market is heavily influenced by the logistics within California. Major gasoline movements occur on pipelines originating in the refining centers to San Francisco and Los Angeles. Were California regularly and significantly dependent on gasoline imports, the principal pricing point, prompt or forward, would probably be C.I.F. San Francisco Bay or Long Beach. Were the two northern and southern pipeline routes interconnected, probably one origin would serve solely as the forward market. Were the pipelines frequently congested, which stakeholders say infrequently happens, additional pricing points might emerge. As a pipeline operator, Kinder Morgan is flexible about the nomination process, allowing rescheduling of when a shipment leaves and substitutions of the recipient until one week before a cycle begins, at which moment the arrangements “freeze”. That flexibility up to one week ahead allows those who bought gasoline but never truly wanted the “wet” barrels to sell the piece later to someone else or to “roll” the shipment to a later cycle. Such activity goes by the name “paper” trading. According to various stakeholders, some trades in the California forward market are indeed paper trades, but by no means a majority, let alone a great majority as in some forward markets. Many stakeholders emphasized the “wet” barrel as the common trading philosophy.

Figure 5



Source: Oil Price Information Service daily West Coast reports.

Among the cross-section of stakeholders interviewed, from major oil companies to independent dealers, there is consensus that a more liquid forward market would be a positive element of California gasoline. Such a consensus is not surprising, for it is difficult to imagine anyone damaged by a more liquid forward market in California specifically. (Whether stakeholders would like more paper trading and the greater presence of speculators that comes with paper trading was not a question asked.) Notwithstanding the desire for a more liquid forward market, only relatively few types of traders trade in the forward market. Even those who do not trade routinely are aware of prevailing prices. Several made mention of adjusting their inventories to the signals in the spread between spot and forward prices. Only a few kept sizeable inventories, however, although that situation appears to be changing as more storage space seems to be coming available.

Specifically, major oil companies, the so-called integrated majors, communicate an attitude of self-sufficiency with respect to the ability to supply the market, and hence do not focus on the forward market. They perceive that forward market liquidity could be greater, and that that development would be desirable, but that government agencies will not be able to provide more liquidity. Some of the majors are offering fixed forward pricing, or formulas linked to OPIS or NYMEX. Some indicate a willingness to sell to reliable, credit-worthy end users on a forward pricing basis over an extended period. But few customers seemingly are willing to take advantage of these offerings. And some customers dispute the willingness of the majors to offer long-term deals fixing a refining mark-up. At this stage, these types of transactions, which are familiar to the aviation industry with regard to jet fuel, have not been successful in gasoline.

From the larger independent refiners, who service the unbranded sector of the downstream market, one hears that more forward price liquidity would be a good thing. They look for forward fixed-price deals, and will sell forward into the pipeline if the transaction looks worthwhile. There also seems to be a willingness to sell directly to a refiner suffering an outage.

Both in northern and southern California, the class of trader encompassing distributors and jobbers aggregates the demand of independent gas station owners, industrial and commercial accounts, and state agencies. These traders negotiate bulk supply deals with refiners on an “unbranded pricing” basis. Because they stand between the physical supplier and the end user, and because they have price risk exposure on any unsold, or undelivered volumes, they mainly maintain a back-to-back balance between purchases and sales. At times, however, when they have a strong feeling about the direction of prices, they try to time their purchases and adjust their inventories. In any case, their operations require an intensive management effort in dispatching, notification about price changes, and monitoring inventories at various terminals. Kinder Morgan, which controls the marketing terminals out of which they operate, does not allow storage of incremental inventory beyond two weeks (if that). Kinder Morgan schedules a tight, top-to-bottom flow through the tanks against weekly pipeline shipments. In other words, inventory games cannot be played beyond a few days quantity of sales, to take advantage of a spot-forward spread in contango (a signal to build inventory), or in backwardation (a signal to reduce inventory as much as possible). These traders pay

attention to the intertemporal price signals, and the related ones in the NYMEX futures markets.

Pipeline traders, along with the cargo traders (often a combined role), appear to be the primary bridge for price formation between prompt and forward markets in California gasoline. Pipeline traders would strongly support more liquidity in the forward market. They would, in fact, create that liquidity if there was a reliable means to tie such forward prices to a common index, such as NYMEX or MOPS Singapore. The international cargo traders propose that California needs both more marine storage and a forward market. They express great confidence that California grade gasoline and components can be found from both the Pacific Rim and East of Panama. In a normally functioning market those supplies would keep a healthy pressure on California prices. But they are disadvantaged by the lack of marine storage (particularly in Los Angeles) and by the lack of forward pricing mechanisms, or so they perceive. "There is no way to hedge [sell forward] a whole cargo," they say. And a drop of five cents per gallon in price, while the ship is on the water, works out to a loss of around $700,000, which is not an acceptable risk. They offered no specific examples of a cargo that was almost but ultimately not sent, however. And partial cargoes can be sent, as when gasoline is sent along with diesel or jet fuel, either of which can be hedged on NYMEX.

Until very recently, no electronic trading platform for petroleum products in California existed. Instead, a number of local telephone brokers canvass the market daily, linking buyers and sellers in prompt transactions, and in the few forward trades that do get reported. Generally, the brokers would like to see more transactions in the forward market. Liquidity is a sign of healthy competition, not to mention a sign of more deals that need brokers. Compared to the types of deals done elsewhere in the U.S., those in California are not very complicated – uncommon are trades such as collars tied to a strip of NYMEX contracts at a set basis differential. As it happens, the NYMEX has recently launched an electronic trading platform on which CARB gasoline can be traded on a differential against the NYMEX contract. Brokers will watch that development closely, since it could cut into their business. So far, no trades have been done in this format. Perhaps California-based traders are not sophisticated, perhaps other forward instruments serve the function nearly as well, perhaps the NYMEX contract has itself insufficient liquidity to set in motion the virtuous cycle of trading volume.

In sum, although the forward market in California cannot be said to function poorly – the second condition in the logical sequence for government attention – neither can the forward market be said to flourish. A number of participants and prospective participants perceive the market as relatively illiquid, especially for the larger quantities associated with a tanker, some 350,000 barrels. If that illiquidity were converted to a cost, perhaps it would be between one and two cents per gallon. Although a higher transaction cost by an order of magnitude compared to active forward markets, one to two cents per gallon does not seem the principal impediment to shipments to California, compared to freight rates on the order of 20 cents from plausible export points or the extra cost of producing CARB gasoline, some 5 to 7 cents. The forward market in California extends one month or so, which is the time necessary for most shipments to arrive in California. Perhaps an impediment to imports is the translation of a tanker

shipment into the pipeline segments that are traded in the forward market, but that complication too seems a minor issue to the functioning of the forward market in California.

IV. State Agencies' Purchases

According to several current suppliers, purchasers in several state agencies, and the Department of Government Services (DGS), which oversees those purchasers, the best estimate of the state agencies' purchases is less than 5,000 barrels per day or 0.5 percent of the entire demand for gasoline within California. Were all state agencies' purchases aggregated, they would amount to the order of magnitude of one pipeline piece per week, that is, to one trade in the forward market per week. One or two trades per day might make a substantive difference to the forward market, but it seems unlikely that one trade per week would make a substantive change in its liquidity. Thus, the third condition in the logical sequence does not seem to hold.

Moreover, it is far from straightforward how the state agencies' purchases would be aggregated to a single weekly trade in the forward market. No central supply point, such as a single pipeline, services state government contracts. Demand is spread from urban center police departments, such as the Los Angeles Police Department (LAPD), to remote mountainous areas under the jurisdiction of the Department of Forestry and Fire Protection (CDF). Each government agency has its own methods for soliciting bids and administering the business. The great majority of state agencies' gasoline is supplied by jobbers who specialize in this geographically dispersed, non-uniform-lot class of trading. Other than Valero and Petro-Diamond, none of the refining companies or large trading companies has chosen to pursue this line of business. The smaller trading companies themselves are unlikely to deal in the minimum quantities prevailing in the forward market.

Since virtually all state gasoline demand is delivered by truck, the job of managing different truck routes and the gasoline specifications required in different parts of the state, including non-concurrent seasonal changeovers in those specifications, finds expression in the contract price itself. Most state agencies' contracts specify a differential (over which the bidding occurs) to a reference price, which is usually OPIS's "unbranded" rack price for the day of the truck delivery prevailing in some part of California. For example, a full truck and trailer load of gasoline delivered to a central LAPD location has a smaller differential than a bobtail truck (small-unit) delivery to Lake Arrowhead up in the mountains. A number of agencies are holders of Card Lock System Cards, which enable their vehicle fleets to pick up gasoline at designated locations on a floating price linked to OPIS's quotations for unbranded rack prices. Nothing in the style of these contracting arrangements precludes the use of another index, such as OPIS's quotation for the prompt cycle on the pipeline or its quotation for one-month forward on the pipeline. For that matter, the contracts could specify differentials (they would surely be different from those employing the current indices) to the price of gasoline in New York harbor. A different index, especially the forward pipeline price, might induce these smaller suppliers themselves to use the California forward market, but the advantages of this displacement are not obvious. The state agencies will continue buying gasoline day to day as they need it, regardless of price and regardless of the intertemporal pricing signal in the spot-forward spread. The state

agencies' suppliers can see even now the intertemporal signals for their own procurement of gasoline.

The state government as a whole could look beyond individual contracts and undertake an aggregate hedging operation operated by the State Treasurer. (After all, state agencies do not routinely issue their own debt individually.) Such a hedging program, which could involve both NYMEX and California pipeline forwards, and rolls between them, might be sensible for the state out of concern for budget planning, quite apart from any benefit to the liquidity of the gasoline forward market. If a state hedging program is deemed to be feasible an immediate and obvious question will be, "How does the state account for the gains and losses?" Do the individual agencies' budgets adjust with the month-to-month outcome of the hedging? The aggregate demand of all deliveries throughout the state could be hedged against, say, the forward pipeline prices for Los Angeles and San Francisco as posted by Platts and OPIS. The differential between the daily and particular rack price and the forward market price would represent the gain or loss that could be booked to the particular agency's hedge account, at the State Treasurer's level. A full consideration of such strategies was beyond the scope of this study. The relevant point is that such a hedging program could direct more volume to the California forward market. But that volume would have to be paper trading, since the state would acquire the "wet" gasoline through its regular contracts. That is, the forward market would already need to allow sufficient paper trading for the state to add further liquidity.

V. Conclusions

From the argument that forward markets are delicate institutions, it does not follow that the absence of a forward market is necessarily indicative of some problem. Rather, the absence of the forward market may indicate that it is not needed because of features of the logistical and distribution system. Just as it makes little sense to have retail stations sell twenty-five different octane levels of gasoline – three seems to suffice – it makes little sense to expect active forward markets in all conceivable regions of the U.S. For several markets to be active, the differences in pricing situations need to be substantive. And those differences need to be sustained and variable. Should a pipeline serving as a city's principal source of gasoline have an accident, causing the spot price of gasoline in that city to spike relative to other locations, the price there for delivery three months later would not likely move from its normal spatial relations. Provided the pipeline could be repaired or supplies diverted within those three months; that three-month forward market in that city is unlikely to be active, for there is no price difference to reflect. In short, one would not expect active forward markets for gasoline in California beyond the time of plausible logistical constraints isolating California from other regions, given that those other regions have active forward markets for gasoline, not to mention that other regions have active forward markets for crude oil.

Logistical constraints within California are on the order of one month. Schedules on the two principal pipeline routes, one from Los Angeles, the other from San Francisco Bay, are settled within a month (namely, within four weekly cycles). Those pipelines are rarely, if ever congested, for more than a few days. Those two pipeline systems do not interconnect except indirectly. No pipelines from other regions reach into California. Extra gasoline must move by ocean tanker, if at all, to California, or by barge between Northern and Southern California. The longest of such tanker trips can be six weeks; one within California a week at most. Meanwhile, the trading that occurs in the forward market within California has a maturity typically of one month, occasionally two months. Given the logistical situation, the lack of two-month and higher maturity in California forward markets is neither surprising nor troublesome.

The one-month-ahead forward market appears to be more active in southern than northern California, and compared to other markets, not all that active even in southern California. Of course, it would be better if these markets were more active and the prices in them more transparent. Even so, traders pay attention to those price signals, especially in regards to making inventory decisions.

Impediments to forward trading are not obvious. Anyone in the wholesale gasoline business – not all that many firms, to be sure – can trade in the forward market. (Put differently, any constraints on trading style are also felt in the spot market.) There does not seem to be a systematic imbalance, meaning, say, far more willing sellers than willing buyers. (Put differently, the reported forward prices seem to be in line with those observed in other regions.) Although one default occurred several years ago, the market has not been plagued by the fear of defaults and bankruptcy. Through the credit checking necessary for wholesale spot markets, prospective counterparties have a

good idea of default risk. There are few or none of the disputes over grade, quantities, and delivery timing that plague other commodity markets. In some forward markets – Brent crude is a good example – some originally minor clause of the contract has become a game of advantage, sometimes to the buyer, sometimes to the seller, and always an impediment to trading. The forward market for gasoline in California does not seem to have such problems. As a result, there is much less scope for the strong leadership of, say, the State of California to insist on customs sensible for the market as a whole, to apply to standards of credit analysis, to balance buyers and sellers, or to go out of its way to include excluded traders.

State agencies weekly buy a quantity of gasoline (i.e., about one million gallons) on the order of one lot in the forward market. An increase in volume of one lot per week would make some difference to the functioning of the forward market, since the daily volume is only a few lots at most, but the state's trading would be unlikely to transform the market. In any case, because the state agencies need gasoline at many locations (and in small amounts), the state itself could not disperse one pipeline lot. It would require gasoline distributors to serve that function, and part and parcel, to handle its trading in the forward market. Its effect on the forward market would need to be indirect. Substantial indirect effects are possible, but not likely. All the state's procedures for procurement and inventory control exemplify the rigidity opposite to the flexibility needed for sophisticated trading in forward markets.

Glossary of Terms

Backwardation: Describes the market condition where the price for nearby delivery exceeds the simultaneously quoted price for later delivery.

Barrel: A unit of measurement equivalent to 42 gallons, abbreviated bbl.

Basis: The basis is a differential to a benchmark price (typically the price of a futures contract traded in high volume) that determines the price of a commodity of a particular grade or at a particular location – the local price is “based on” the benchmark. This differential is not fixed, and the uncertainty created by the fluctuation in the basis is known as “basis risk.”

Blendstocks: Blendstocks are components used in the production of finished motor gasoline. These components include various hydrocarbons as well as reformulated gasoline blendstock for oxygenate bending (RBOB), but exclude oxygenates and butane.

Boutique Fuel: State or local cleaner-burning motor gasoline specifications that are unique to that region of the U.S..

Branded Gasoline: Gasoline purchased from wholesale terminals or sold at retail outlets that are identified by a refiner trademark.

CARB: The California Air Resources Board. It is common to refer to the reformulated gasoline that meets the standards of the California Air Resources Board as “CARB gasoline.”

CARBOB: RBOB that meets the standards of the CARB.

Carrying Charges: The cost of carrying a commodity forward in time, including warehousing fees, insurance premiums, and capital expenses. When the difference between the price for a nearby delivery date and the simultaneously quoted price for a more distant delivery date exactly covers the total cost of holding the commodity for that time, the price difference, or *spread*, is said to be at full carrying charges.

C.I.F.: C.I.F. stands for cost, insurance, and freight paid, paid by an exporter that is, and so represents the price of the good on board a vessel in the importer's harbor. Should the exporter be responsible only through the loading of the vessel and the importer responsible for the freight charges, the price is F.O.B., namely free on board in the exporter's harbor. Thus, a price quoted C.I.F. should always be higher than a price for the good quoted F.O.B.

Collar: A collar specifies the minimum and maximum price a buyer must pay for a contracted commodity.

Contango: Describes the market condition where the price for nearby delivery is below the simultaneously quoted price for later delivery.

Crack Spread: The simultaneous purchase or sale of crude futures and the sale or purchase of refined petroleum product futures. This *spread,* which represents the *refining margin*, can be "simple," that is, a position in one refined product and an equal but opposite position in crude oil, or "diversified," in which positions are held in more than one refined product with an equal but opposite position in crude oil.

Credit Risk: The uncertainty surrounding the possibility that someone will fail to fulfill a contract. For example, someone with a *long* position will *default* on their obligation to pay for and take delivery in a timely manner.

Dealer Tank Wagon price: The delivered price of wholesale gasoline charged by refiners to refinery owned retail outlets, often abbreviated DTW.

Default: Failure to make required payments, accept delivery, make delivery, or to comply with other conditions of an obligation or agreement on a timely basis.

Exchange Agreement: A contract between two refiners to trade gasoline. The trade is typically geographic, with each company giving to the other in a different region (e.g., refiner A gives to refiner B in San Francisco Bay and refiner B gives to refiner A in Los Angeles). The trade may also involve different grades or different products. It is a type of *swap*.

Exchange for Physicals: An exchange for physicals, often abbreviated EFP, is a double transaction, one part in futures contracts conducted away from the trading floor of the futures market, the other part involving the physical commodity, typically not in the contract grade or at the delivery points.

Forward Contract: In its most general sense, a forward contract is any agreement calling for the execution of some act in the future, including, but not limited to, futures contracts. Usually, the term is used not to refer to standardized futures contracts but to those contracts containing conditions tailored to the particular needs of the contracting parties and which, should either party's needs change, must be renegotiated privately rather than offset. Other times, forward contract refers to relatively standardized instruments but with trading

Futures Contract: Futures contract abbreviates the phrase "contract for future delivery." It usually refers to one of the standardized contracts traded in high volume on an organized exchange, with procedures for a clearinghouse and margin to ensure performance of the contracts. In effect, futures contracts become traded in their own right. In active futures markets, several delivery months trade simultaneously.

Hedge: A position taken in *forward* or *futures* contracts by a firm dealing in that or related products to reduce risk in the *physical position*.

Independent: "Independent" generally refers to a company that is not vertically integrated from crude oil to retail outlets. An independent refiner does not own crude oil assets, and may not own retail outlets. Independent *jobbers* belong to companies that do not have refining assets, and may not have retail outlets. An independent retailer is

an individual or chain of retail outlets that are not owned by a refiner. Independent jobbers and retailers may sell *branded* or *unbranded* gasoline.

Inversion: In gasoline wholesale markets, an inversion describes the market condition where the branded rack price is below the unbranded rack price. To confuse matters, the more general use of inversion is as a synonym for *backwardation*.

Jobber: A jobber is an individual distributor who buys *loads* or less of branded or unbranded gasoline at wholesale terminals and resells the product to retail outlets and large end-users, such as government agencies.

Liquidity: Liquidity is a term that generally represents the trading activity in a market. Liquid markets tend to have higher volume and less price sensitivity to large trades than illiquid markets.

Load: A load is the standard quantity purchased by a jobber over the rack. One load is one truck compartment, or 8,000 gallons.

Long: Long describes the market position of someone who has bought something, whether the physical commodity or a futures contract. When making the trade, the person is said to "go long." Long also refers to the net position of someone who has contracted to buy more than they have contracted to sell. Long has also come to indicate the person who holds the position.

Major: A "major" is a refiner that is vertically integrated, owning assets in crude oil acquisition, refining, product distribution, and retail outlets. Currently, there are six majors operating in California. Contrast with *independent*.

Marketing Margin: Also known as the "dealer margin," the marketing margin represents the contemporaneous conditions in the wholesale and retail markets. Specifically, it is the difference between the simultaneously quoted retail product price, including all relevant taxes, and the wholesale price of that product.

MOPS: Mean of Platts Singapore (Platts is the dominant industry pricing publication in the region).

Nomination: Before someone can use the transportation services of a pipeline or cargo system, the service must be requested, or "nominated." The nomination includes the physical infrastructure, origin, destination, supplier, and purchaser. Transportation companies have their own procedures for accepting nominations and scheduling shipments.

NYMEX: New York Mercantile Exchange. Also known as "The Merc."

OPIS: Oil Price Information Service.

Paper Market: The paper market is often used synonymously with *forward* and *futures markets*, and generally refers to positions entered into these markets with intent to trade out, rather than accept physical delivery. Contrast with *physical market*.

Physical Market: In the physical market, the product changes hands upon completion of a transaction. This market is distinct from paper markets, where contracts change hands, possibly many times, without delivery being made. The physical market need not be simply *spot* trades.

Physical Position: Someone holding a product, or a commitment to make or take delivery of a product, is said to have a position in the *physical market*.

Piece: A piece is the standard lot size of transactions in the pipeline or cargo markets. A pipeline piece is 25,000 barrels, and a cargo piece is 250,000 barrels.

Pipeline Batch: The amount of a product injected into a pipeline for delivery to a terminal is called a batch. Pipeline carriers often specify minimum batch sizes, which are typically between 5,000 and 25,000 barrels, to preserve product flow through the pipeline system.

Prompt Market: Products that are available for delivery soon are traded on the prompt market. The product does not change hands immediately, and so the transaction is not a *spot* transaction, nor does it take place appreciably in the future, and so is not a *forward* transaction. Though different from a spot market, it is common in petroleum markets to use the words prompt and spot interchangeably.

Rack: A rack is a truck loading facility at a wholesale distribution terminal. There are typically several racks at a terminal, where *jobbers* purchase gasoline and other products for distribution to end-users.

Refining Margin: The refining margin is a *spread* that represents the contemporaneous conditions of the crude oil and *spot* or wholesale product markets. Usually represented in dollars per *barrel*, is the difference between the simultaneously quoted spot or wholesale product price and the spot price of crude oil. Compare to *crack spread*.

Reformulated Gasoline: Finished motor gasoline meeting the minimum requirements of the Environmental Protection Agency (EPA) established under the Clean Air Act.

Roll: The transfer of a position from one futures period to another involving the purchase (sale) of the nearby month and simultaneous sale (purchase) of a further-forward month. A roll postpones an obligation to either take or make delivery on a futures contract. The existing position is liquidated and simultaneously reinstated in another delivery month, and a payment is made (or received, as the case may be) equal to the difference between the price for the two delivery dates. In this most common sense, roll implies the special class of a “roll forward,” namely rolling a nearby futures contract into a more distant contract. “Roll back,” contrary to natural usage, means to roll a futures contract for distant delivery into a nearer month. A “transfer” is a roll when the contract is just about to expire; that is, the delivery month has arrived.

Short: Short describes the market position of someone who has sold something, usually a futures contract. If the sale called for immediate delivery, the position could not be kept open; hence, a short position usually has some degree of future commitment about it. Short also refers to the net position of someone who has contracted to sell more than he has contracted to buy. Short has also come to indicate the person who holds the position.

Spot: The term "spot" refers to a good that is right at hand, and so is available for immediate delivery. The price paid for a good to be delivered immediately is said to be the "spot price." In petroleum markets, *unbranded rack* sales are said to be "spot wholesale" sales.

Spread: A spread is the difference between the prices of a commodity for two different dates of delivery or at two different locations (the prices quoted simultaneously). The term is also used to describe the trades necessary to achieve such an implicit position in the market, for example, by the purchase of a nearby futures contract along with the sale of a futures contract with a more distant delivery date. The difference in price between later delivery and earlier delivery is the *carrying charge* for that time period.

Strip: A series of simultaneously entered consecutive *forward* positions covering a given time period. For example, someone in January may buy a strip of Los Angeles gasoline by entering a *long* position in the February and March forwards, paying a price equal to the average of the February and March forward prices.

Swap: A swap can be an informal agreement to exchange gasoline available today, say in Los Angeles, for gasoline next month, say in San Francisco. A swap can also be much more forward, with a price attached, paid by the party whose gasoline is more valuable by time or space. A swap can also be more routine and more standardized. In many commodities they have developed into markets. In these cases, they take on many features of a *forward contract*.

Tariffs: A regulated schedule of rates and general terms and conditions under which a pipeline carrier will transport refined products.

Throughput Tanks: Storage tanks at common carrier wholesale terminals are used exclusively for temporary storage, with inventories held just long enough to keep the terminals supplied between pipeline cycles. Since these storage facilities are used together with the pipelines to maintain product flow throughout the system, these tanks are referred to as "throughput" tanks.

TOCOM: Tokyo Commodities Exchange, an organized futures exchange principally trading precious metals and petroleum.

Unbranded Gasoline: Gasoline sold at wholesale terminals or retail outlets that are not identified by a refiner trademark.